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EVALUATION OF ALTERNATIVE SUBWAY ROUTES

By B. A. Griffith<sup>1</sup> and H. G. von Cube<sup>2</sup>

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SYNOPSIS

A practical automatic computer method of assigning passenger trips to a proposed traffic facility is outlined and the report gives the results of applying this method to proposed subway systems in Metropolitan Toronto.

Where adequate origin-destination data are available, the method can be used directly for a rapid transit system, or with minor modifications for other types of traffic facilities, such as commuter lines or expressways.

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It is obvious that when \$200,000,000 are to be spent on a facility such as a subway, it is most desirable to ensure that the maximum benefits will be derived. Authorized by the Metropolitan Toronto Council to report on the most desirable location of an east-west subway, the Metropolitan Toronto Planning Board faced the problem: How could the merits of any number of hypothetical transit lines be evaluated?

Besides thorough studies of the engineering feasibility in construction and operation, studies of the economics of the situation, and the future development of the city, there was the problem: What usage could be expected of each of the hypothetical rapid transit facilities? To solve this problem, the writers' firm was contracted to work on the problem with the objective of predicting passenger volume and behavior on various alternative new subway lines proposed for Metropolitan Toronto.

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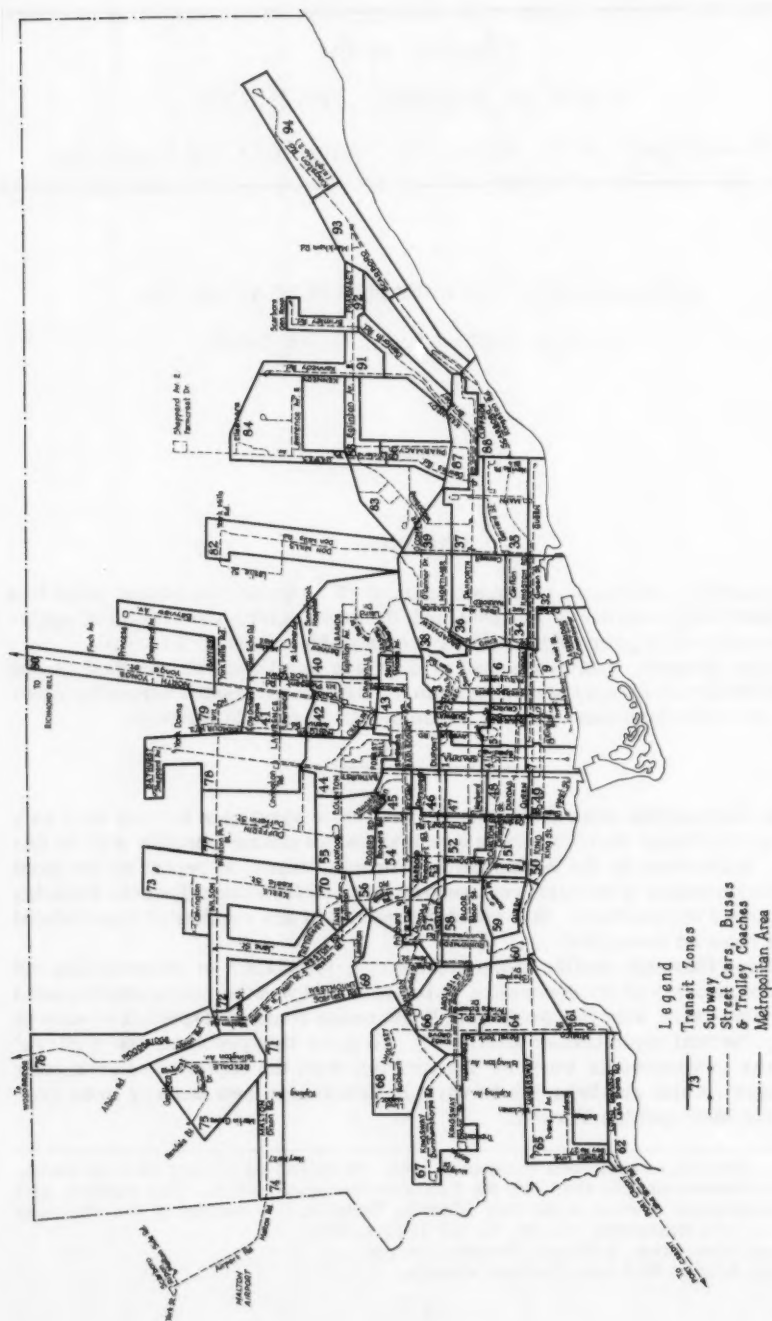


FIG. 1.—PUBLIC TRANSIT SYSTEM AND TRANSIT ZONES IN METROPOLITAN TORONTO.

Thus the problem may be formulated as follows: Given a subway route with specified stations, train speeds, and train frequencies (headways), what would be the expected usage under present conditions? In order to arrive at any answer to this problem, it is first necessary to know what the present conditions are, that is,

1. What is the total number of trips that people currently make via public transit?
2. What are the origins and destinations of these trips?
3. How attractive is a subway for a passenger?

Data obtained from a comprehensive survey conducted by the Toronto Transit Commission (TTC) on twenty eight public transit routes provided the basic information for 50,000 riders as to origin and destination of a trip, number of routes and transfer points, and time and purpose of trip. The survey sample was expanded to represent the daily total revenue passenger trips.

To reduce the volume of data cards at hand, all trips with common components were summarized. Although five different periods were allowed for in a day, for our purpose only two were distinguished, that is, the rush-hour period and all other periods.

In addition, ninety four transit zones were established in each of which the centroid represented a weighted origin or destination for all stations in that zone. The size and shape of each zone was determined by considerations of trip density in the area, geographical configuration, natural and man-made obstructions, and land use and location (Fig. 1). Thus, zones in the downtown business area were much smaller than in the suburban areas (not shown in Fig. 1).

At this point it was necessary to build a model describing all transit facilities. It will be noted (Fig. 1) that the vast majority of streetcar and bus lines are operated on east-west or north-south lines somewhat irregularly spaced throughout the city. Thus, by superimposing upon the city map a rectangular coordinate system with the X-axis parallel to the direction of the main east-west streets and by assigning coordinate values to O-D points, one could calculate the rectangular distances of trips and assume these to be equal to the distance travelled on surface transit facilities. Given an average speed for streetcars and buses, the travel time could also be calculated. In some cases, barriers, natural or man-made, such as the Don River Valley, force travelers to use routes considerably out of their rectangular way. Therefore, a minor program was developed to find the nearest bridge crossing such travel barriers between O-D so that the rectangular distance could be adjusted. One may expect some loss of accuracy or distortion due to the card reductions, the use of zones rather than transit stations, etc; however, tests at this stage revealed that the average deviation was less than 2.5%.

The existing Yonge Street subway has a significantly higher speed than the surface transit lines. Thus, two centroids can be connected in two essentially different ways:

- a. Using a rapid transit facility for part of the trip or the whole.
- b. Not using a rapid transit facility.

By superimposing more rapid transit lines on our network, one increases the number of possible connections between two points using the subway for

part or the whole trip. The computer program developed, handled up to ninety possible subway connections between two centroids. Such a subway system may have six junctions or intersections.

The travel distance from any origin to any destination and using the rapid transit facility then consisted of:

1. Access distance: that is, travel to and from the nearest subway station by surface routes.
2. Rapid transit distance: that is, travel from entry to exit station on rapid transit.

In order to allow for the difference in speed of travel between travel on rapid transit and travel on surface routes, the rapid transit distance was converted into equivalent surface distance according to the various speeds set for any of the proposed subways. In addition, allowances were made for transfer times according to the frequency of trains or streetcars and buses.

After computing the time and distance of travel on all alternative routes available using rapid transit for all or part of the trip, the best route was selected and this compared with the time and distance of travel exclusively by surface transit, thus obtaining time and distance lost or saved. In practice, however, not all transit passengers having identical origins and destinations use the route calculated to be the most efficient.

At this point, it was necessary to determine why a particular passenger chooses one travel route in preference to an available alternative. Here, one is really concerned with motivation. It seems likely that several factors may influence him—convenience, comfort, time, distance, companionship, scenery, etc. Of these, only time and distance are readily measured for each alternative route.

To determine the number of passengers who would use a rapid transit route in preference to a surface route, a study was made of passengers using the Yonge Street subway to determine their time and distance benefits compared to travel by the surface route. For all trips between the same O-D, it was known which routes were actually chosen and so it was possible to prepare a tabulation showing the percentage of individuals who do, in fact, choose to use the Yonge Street subway. This percentage was plotted against time (or distance) saved and smooth curve was drawn through the points obtained (Fig. 2). The scatter of points about this curve was found to be considerably less for time than for distance. Such a curve represents what is known in economics as the indifference in choosing between two alternatives: that is, an indifference curve. Due perhaps to improved surface facilities during rush hour periods, the curve for those periods is somewhat different than for the remainder of a normal week-day (Fig. 3).

Before these indifference curves were developed, the estimated number of rapid transit passengers on a hypothetical transit system was obtained by assuming that 100% of all passengers not losing time would use rapid transit. To determine the difference between the old and new method, a comparison was made. The assignment based on an indifference curve produced an increase on the average of 8% and a more realistic passenger flow.

If we accept such a curve as part of our model, there result

- (a) Demands for trips between centroids.
- (b) Travel times and distances for all trips on alternative routes.

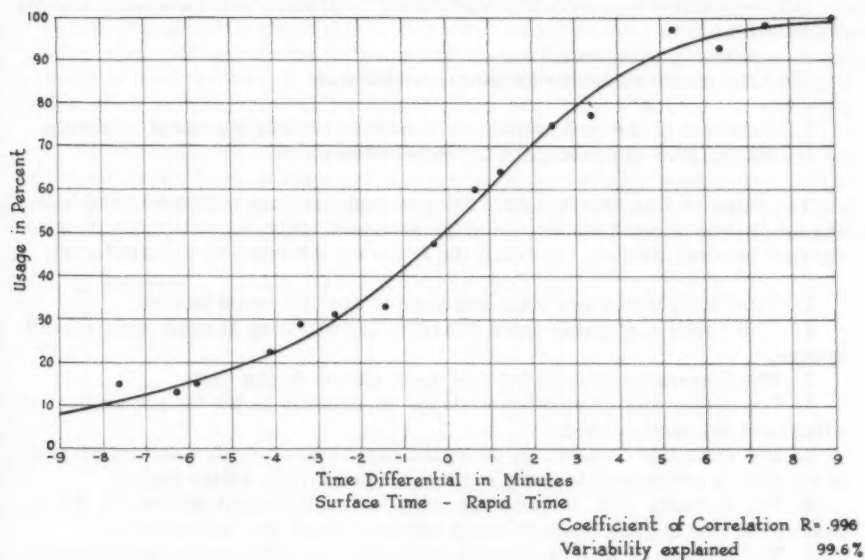


FIG. 2.—PERCENTAGE USAGE VS. TIME DIFFERENTIAL IN OFF-RUSH-HOUR PERIOD.

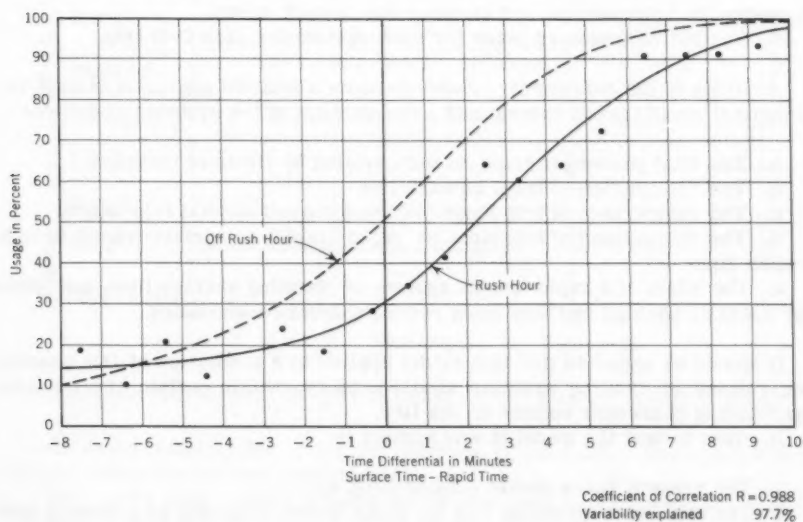


FIG. 3.—PERCENTAGE USAGE VS. TIME DIFFERENTIAL IN RUSH HOUR PERIODS. (FOR COMPARISON THE OFF RUSH HOUR RELATIONSHIP IS ALSO SHOWN.)

(c) An indifference curve for determining the preferred route among several alternatives.

Thus the entire computer program consisted of:

- (i) Selection of the best transit route with or without the use of a subway.
- (ii) Assignment of passengers to the selected route.

The output of this program gave the expected passengers boarding and leaving the subway at each station along the proposed route, as well as the volume carried between stations. In detail the following information was produced:

1. Total daily passenger trips assigned to each assumed facility.
2. The number of passengers boarding and alighting at each rapid transit station.
3. The passenger volumes between each station on the line.
4. The origin and destination of trips in relation to the transit station of origin and destination used.
5. The time lost or saved by using the rapid transit system for all or part of the trip in preference to using surface transit for the entire trip.
6. The distance lost or saved by using the rapid transit system for all or part of the trip in preference to using surface transit for the entire trip.
7. The division of total trip length by distance on rapid transit and distance on surface transit.
8. The division of the above data by 'rush' and 'off-rush' travel periods of the day.
9. The summary of the number of passengers shown to use the rapid transit system by units of time and distance lost and/or saved.
10. Number of transfers made for each system for each O-D trip.

Analysis of the assignment results permits a detailed appraisal of each hypothetical rapid transit system and a comparison of the systems as follows:

- a. The total passenger trips on each system by times of travel.
- b. The distribution of trips on each line.
- c. The comparison of trip length on rapid transit to total trip length.
- d. The comparison of trip time on rapid transit to surface transit to total transit time.
- e. The effect of a rapid transit system on existing surface lines and hence the possible savings on those lines resulting from rescheduling.

It should be expected that this model applied to a prediction of the passenger volume of existing systems should produce, within certain error limits, the existing passenger volume on the line.

In order to test the model it was applied to:

1. The present Yonge Street subway (Fig. 4).
2. The east-west streetcar line on Bloor Street regarded as a subway with speeds and headways conforming to those presently in use on that line.

In both cases, the travel pattern was reproduced to a high degree of accuracy. For one or two sections of these lines, zoning effects produced discrep-

ancies much larger than those found at all other sections. For example, the center of one downtown zone was so located that the majority of trips from that zone used surface routes to reach the Yonge Street subway, whereas in fact, many of them would and do board the Yonge subway at Union Station. By splitting such a zone to yield two centers, one near Queen Street, the other near the Union Station, this difficulty could be overcome.

Discounting the discrepancy between predicted and existing passenger volume at the Union Station, the difference, in percentage between the predicted and the existing passenger volumes is 1.5%. The difference (as a percentage of the total passenger volume including the Union Station) is 9.8% and lies

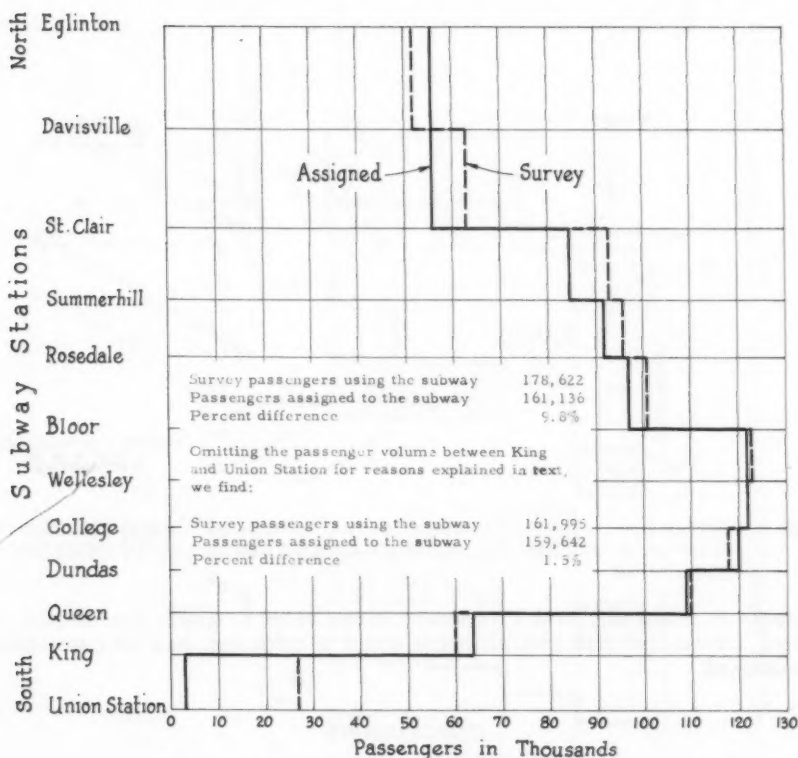


FIG. 4.—ASSIGNED AND SURVEY PASSENGER VOLUME ON YONGE SUBWAY

within error limits. Thus, for the purpose of prediction the principles developed proved to be very satisfactory.

The model which has been described was used to determine the expected 'present' usage of the proposed Bloor-University line<sup>a</sup> which the TTC plan to build. It was also used to test one or two other proposed subway routes. One

<sup>a</sup> The Bloor-University line runs east-west on Bloor St. and Danforth Ave., with a spur southward on University Ave. to join the Yonge St. subway at Union Sta. This line is also referred to as the 'Wilson line' (cf. Fig. 6), after the design engineer, Mr. Norman D. Wilson.

of these, the so-called U-line<sup>b</sup> (of which two versions, U<sub>1</sub> and U<sub>2</sub>, were considered) gave a slightly better expected total usage than the route planned by the TTC and also gave considerably more relief to the overcrowding on the present Yonge Street line (Figs. 5 and 6). The principle objection to the U-line is its failure to join the east and west parts of Bloor Street by a direct subway line, thus removing surface traffic from the congested central part of Bloor

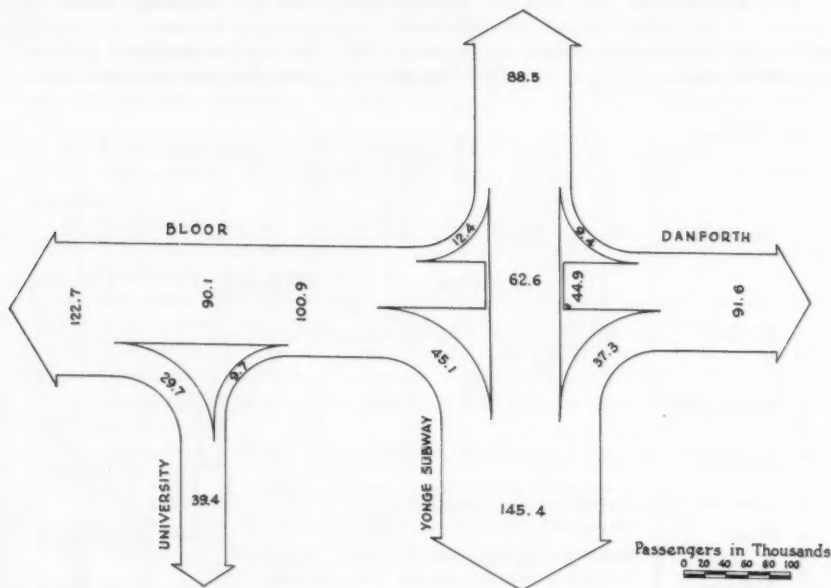


FIG. 5.—INTERCHANGE OF PASSENGERS ON THE PROPOSED BLOOR—UNIVERSITY SUBWAY, AT INTERSECTIONS OF YONGE AND BLOOR AND AT UNIVERSITY AND BLOOR.

Street. It would of course give some indirect relief to this central section of Bloor Street; that this indirect relief would be sufficient, has been seriously questioned.

### CONCLUSIONS

The model which was presented herein can be adapted to tests of future subway proposals, to tests of commuter routes on rail lines, and (with minor modifications) to assignments of traffic to expressways. In the future, it is hoped that the application of such a model will be considered in conjunction with engineering studies, and that such model studies will have the whole-hearted support of all interested parties. In this way it will be possible to build into the

<sup>b</sup> The U-line runs for a short distance on Bloor St. West, turns south to Queen St., proceeds east on Queen St., and later turns north to continue a short distance east on Danforth Ave. (see Fig. 1).

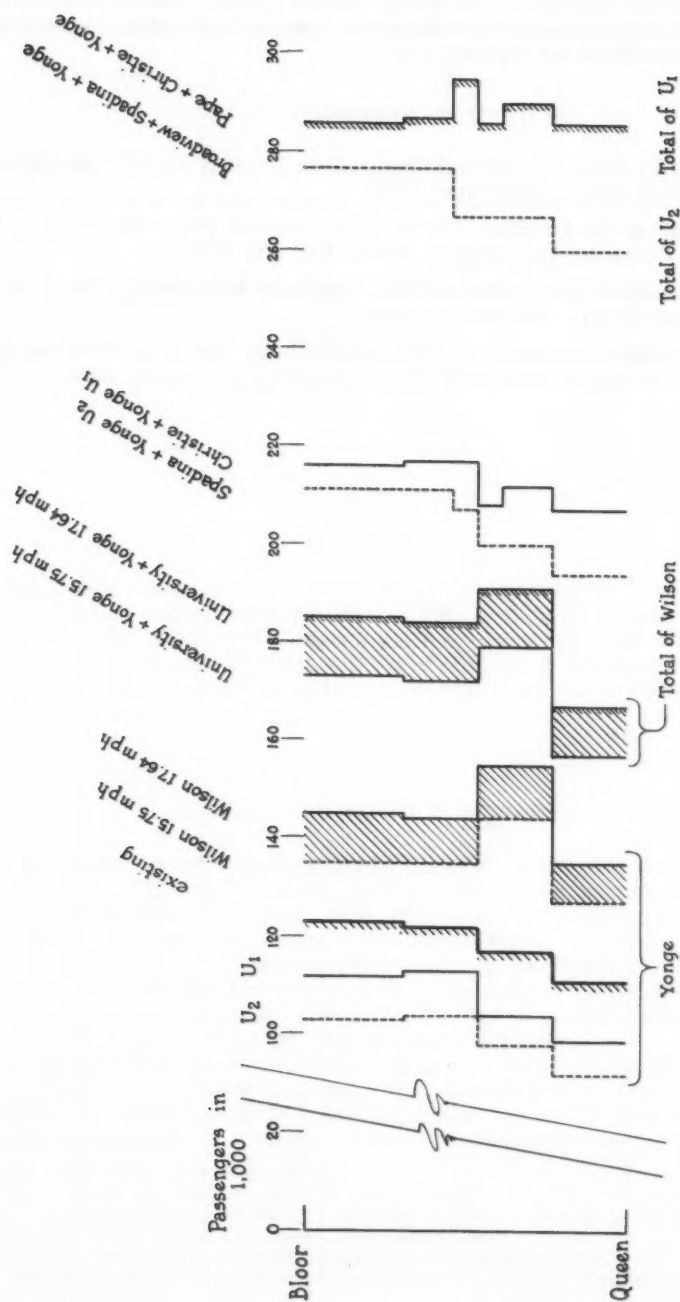


FIG. 6.—NORTH-SOUTH MOVEMENT OF PASSENGERS ACCUMULATED FOR BLOOR-UNIVERSITY, U<sub>1</sub> AND U<sub>2</sub> RAPID TRANSIT SYSTEMS.

model realistic descriptions of details such as speeds, stations, headways and transfer times for subways and commuter lines or road widths, speeds, and interchange facilities for expressways.

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PUBLIC TRANSIT IMPROVEMENTS IN TORONTO<sup>a</sup>

By W. F. Irvin<sup>1</sup>

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SYNOPSIS

This article traces the significant transit developments in Toronto during the past century; describes the beginning of the latest phase, as the city turned to rapid transit with the construction of the first subway in Canada on Yonge St.; reports some of the results during the first 5 yr of that initial venture in rapid transit; and tells of plans for further rapid-transit extension during the next decade and beyond.

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HISTORY OF TRANSIT IN TORONTO

In discussing transit improvements in Toronto, Canada, it is appropriate to recall that in 1948 the first local public transportation service was started with a horse omnibus service on one 2-mile route.

In 1861 a franchise was granted to the Toronto Street Railway for the operation of horse-drawn rail transportation, with horse-drawn street cars to operate at not more than 30-min intervals and a speed of 6 mph. This was the first street railway in Canada. This point seemed to mark the beginning of a series of 30-yr cycles of transit improvements in Toronto.

In 1891 the horse cars were replaced by an electric street-car system operated by the Toronto Railway Co., which was granted a 30-yr franchise stipulating that the fare would be 5¢. As the city grew beyond the 1891 limits covered by the franchise, the company refused to extend services unless allowed

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<sup>a</sup> Presented at the May 1959 ASCE Convention in Cleveland, Ohio.

<sup>1</sup> Asst. Mgr.—Development, Toronto Transit Comm., Toronto, Canada.

to raise the fare. This the city was unwilling to permit. The city then organized its own Civic Railway system to serve parts of the expanded city beyond the limits of 1891.

Prior to expiration of this franchise in 1921, by popular vote, the citizens elected to take over the assets of the private company and combine all operations within the city under an appointed public commission. This was the beginning of publicly owned transportation in Toronto under the Toronto Transportation Commission. After  $32\frac{1}{2}$  yr of service this City Commission was replaced in 1943 by another, the Toronto Transit Commission (TTC), charged with responsibility for transit operations throughout the entire and newly organized Toronto Metropolitan area of 240 sq miles. This changeover came about just 3 months before the opening of Canada's first rapid transit subway, which was the culminating achievement of many years of outstanding public service rendered by the late Wm. C. McBrien, Chairman of the former Commission for 21 yr, who died 3 months after it was opened.

This subway marked the beginning of a fourth 30-yr cycle of public-transit improvements in Toronto, the end of which will see the termination of street-car operation in Toronto (probably in Canada as well) and the completion of a basic network of rapid-transit lines, which will serve the needs of the Metropolitan area of that day and after.

#### SUBURBAN SERVICE IN FRINGE AREAS

After taking care of the reasonable needs of city areas, the original Commission, in about 1923, was approached by various suburban municipalities on the fringe of the city seeking transit service in their expanding areas.

By reason of the Legislative Statute under which the Commission operated, it could not extend services beyond the limits of the city of Toronto except under a service-at-cost contract with one or more of the adjoining municipalities. In time fourteen or fifteen such contracts were entered into with suburban municipalities whereby the Commission undertook to supply equipment and manpower and to operate the service under a separate fare, but with the stipulation that any operating loss would be paid by the municipality and any operating profit would go to the municipality. The first of such subsidized services was started in 1924. This arrangement proved mutually satisfactory and in some cases returned a handsome profit to the municipality involved. This type of subsidized service is cited herein because of present conditions in the transit industry, which suggest that subsidized service may be the answer to the transit problem in some communities.

#### THE BIRTH OF RAPID TRANSIT IN TORONTO (AND CANADA)

Probably the most interesting and spectacular story concerning Toronto relates to the Yonge Subway (Fig. 1).

The idea of a rapid transit service in Toronto was first mooted about 1911, at which time the city had a population of about 375,000 and the whole Metropolitan area had a population of only 405,000. Although some preliminary plans were drafted, nothing was done at that time nor for a period of over 30 yr, except that just before the depression of the early 1930's another series of studies

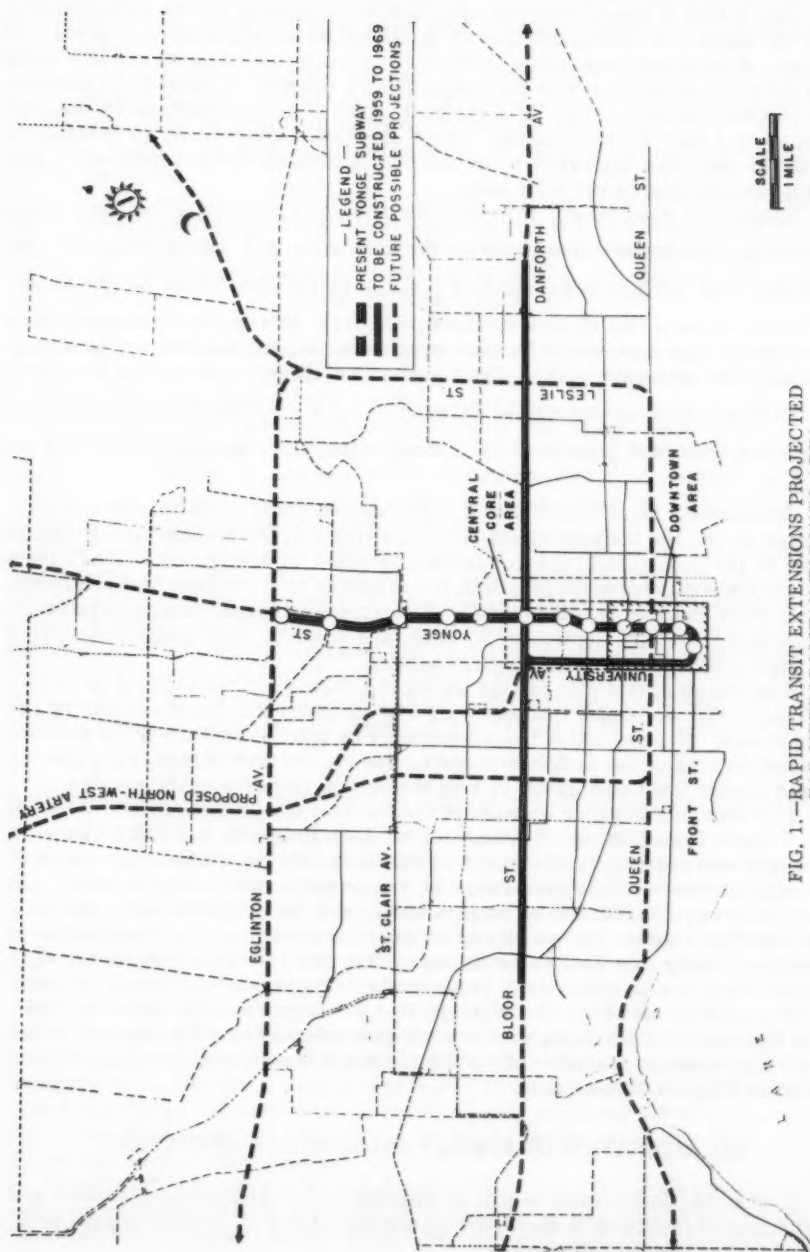


FIG. 1.—RAPID TRANSIT EXTENSIONS PROJECTED FOR METROPOLITAN TORONTO AREA

was begun looking to the possibility of rapid-transit service. These ideas, however, were quickly shelved when the depression struck.

About 1940 it became evident that, due to increasing growth and population in the north end, additional transit facilities must be provided to serve that area. A proposal was made to the city to build two major street extensions to the north, in which it was the Commission's intention to extend car services to that section of the city. The question was put to the electors but was defeated by a very narrow margin. The Commission then turned its attention to what at that time appeared to be its only alternative—the construction of a rapid-transit line to the north end.

Initially it was thought that this might be a sub-surface car-line which would operate in the subway to about St. Clair Ave.,  $2\frac{1}{2}$  miles from the city center, then surface and continue  $3\frac{1}{4}$  miles to the city limits on the street. Critical examination of this proposal, however, forced the conclusion that a facility of this type would become overloaded almost as soon as it could be built. The alternative of a third-rail rapid-transit system was therefore adopted and the line extended to Eglinton Ave.,  $3\frac{3}{4}$  miles from the city center and a total of  $4\frac{1}{2}$  miles from Union Station, the southerly terminal of the line.

Immediately after World War II, preliminary plans were drafted and estimates made. Not because of any legal requirement, but because of the magnitude of the undertaking, the Commission decided to ask the city to call for a vote of the taxpayers on the proposal. It was passed by an overwhelming majority, after which contract drawings and specifications were prepared and contracts let. Work was started on September 8, 1949, and the line was opened for service on March 30, 1954 as Canada's first subway.

It is unique in this regard, that among the subways of the world it is the only one, so far as known, that was built with monies contributed entirely by the car riders. In other cities the municipality or state assumes a large proportion of the cost of the subway structure, leaving the car riders to pay for the rapid transit fixed equipment, rolling stock, and operation of the service.

This was only possible because of the fact that the original indebtedness of the Toronto Transportation Commission had been gradually reduced to the point where it was completely eliminated in the early 1950's. In addition, because of greatly inflated wartime revenues, the Commission had accumulated a "nest egg" of about \$20,000,000 of surplus funds, and this, together with new borrowings (well within its capacity to underwrite) permitted the Commission to build and equip this first subway, using its own financial resources. The Commission has no authority to issue bonds on its own behalf, but it requisitions capital monies from the Metropolitan government on the latter's credit. The Commission, however, services all such debentures. The capital cost of the Yonge subway, exclusive of rolling stock and shops, was about \$52,000,000 or about \$11,500,000 per mile.

#### CO-ORDINATION OF SUBWAY AND SURFACE OPERATIONS

It was the Commission's aim in planning the co-ordination of surface and rapid transit facilities to divert the maximum volume of surface transit traffic to the rapid transit facility:

1. To ensure the maximum benefit to the greatest number of riders through improved speed of travel, greater convenience and comfort, and more dependable service because of freedom from traffic delays, weather and other extraneous causes.

2. To ensure the maximum economy of service by reason of the tremendously greater capacity of the rapid transit facility on which the service, once established, could be greatly expanded at relatively little cost.

3. To realize the maximum return on the investment and greatest utilization of the facility.

4. To provide the most attractive transit service possible and one which would be competitive with the private automobile in the matter of speed, convenience and economy to the end that the transit system might at least maintain its competitive position in the local transportation picture, and eventually increase its share of the total urban passenger traffic.

In furtherance of these aims the Bay carline was continued east on St. Clair to connect with the subway instead of turning south and continuing to and through the downtown area parallel to Yonge St.

The Yonge carline north of Eglinton terminal station was converted to trolley coach operation, and the North Yonge bus, which formerly fed into the Yonge carline at the City Limit, was extended 2 miles to the Eglinton terminal and now operates express over this portion of its route, thus saving an added 5 min for all passengers from north of the City Limits.

This method of operation helped to relieve the load on the Yonge trolley coach north of Eglinton Ave., but as a further assistance in that regard the service on two streets parallel to Yonge were increased to attract additional riders to them. Lawrence crosstown bus was also split in rush hours and direct service to the Eglinton subway was provided in rush hours. These steps contrived to keep the load on North Yonge St. within manageable limits, and at the same time increased the loads coming to the terminal from East and West, giving a better distribution of passengers and vehicles. Two other services on streets paralleling Yonge St.,  $1\frac{1}{4}$  miles away on either side, were routed into Davisville Station,  $\frac{1}{2}$  mile south of Eglinton, to assist further in spreading the concentration of feeder services at the north end of the line.

In the fall of 1957, two additional routes from the east on Eglinton were fed into Eglinton station following a major street extension. As a result, this terminal handles about 105,000 passengers per day, of whom 15,000 per maximum hr travel in the heavy direction in either rush period and another 3,000 in the opposite direction. This terminal handles about 460 bus movements in or out during the maximum hour of the rush period.

In order to make the transfer between surface feeder services and the subway as attractive and convenient as possible, considerable effort was expended in the design of off-street transfer facilities. Since the subway is right under Yonge St. from College St. south, the lower five stations are right under the street and it was not possible to provide transfer facilities within a paid area. Transfers at these points are handled by paper transfer as at any other intersection between surface routes.

Because of the heavy transfer movement at Bloor St., it was desirable to provide facilities within a paid area, but because of the heavy Bloor car service and high property values it was not possible to do this in an off-street

loop. The solution in this case was to widen the street and pavement for about 400 ft, and to establish a paid area loading and unloading platform in each direction within a walled area in the center of the street, completely isolated from the rest of the street, save at the ends, and around which vehicular traffic flows without interruption.

Generally speaking, the following principles have governed in the matter of co-ordinating subway, street-car, trolley coach and bus services:

1. Locate the foregoing facilities progressively in that order under the heaviest loads.
2. Use the lower capacity services as collectorsto feed the higher capacity services.
3. Parallel major facilities with minor facilities no further than necessary to accumulate a reasonable load to feed into the major facility.
4. Never duplicate a major facility by a minor facility on the same route.
5. Make transfer facilities from one service to another as convenient as possible.

#### SOME BENEFITS OF THE YONGE SUBWAY

While only  $4\frac{1}{2}$  miles long and only 5 yr old (as of 1959), the Yonge subway in that time was carried 361,500,000 total passengers and is currently carrying 6,220,000 passengers per month, 245,000 per average weekday but up to 260,000 on high days, and up to 29,500 per maximum hr one-way. In the pre-Christmas period of 1958 it carried up to 320,000 passengers per day and 31,000 passengers per maximum hr one-way. Its rated maximum hour capacity is 40,000 passengers per maximum hr one-way. In the 1958 pre-Christmas period, therefore, it reached 77% of its rated capacity, but it normally operates at around 70% of capacity. This has been a much faster rate of growth in traffic than anticipated, and was partly due to continued and unusually rapid residential development in the northern suburbs.

The popularity of subway service and rapid growth in subway traffic on this first line has sparked a demand for rapid transit extension to the east and west ends.

Some of the benefits accruing from this first subway venture are as follows:

1. It has solved the problem of adequate service to the rapidly expanding north end of the city—no other solution could have met this great need.
2. It has greatly improved accessibility to the central city area for thousands of transit riders—east and west as well as north.
3. It has greatly increased the passenger capacity of the system's "main" line. The pre-war load on the Yonge carline just outside the downtown area was 52,000 passengers per day. During World War II this went up to about 100,000 per day with 12,000 in the maximum rush hour one-way. Now a normal-day load on the subway at the same point is about 170,000 passengers per day with 27,000 in the maximum hour one-way. Although the subway is only one of ten railed services entering the "downtown" area, it handles the following percentages of transit and total passenger traffic into and out of that area:

	% Transit	% Total
4 Hours (2 AM Rush) (2 PM Rush)	40	26
12 Hours (6.30 AM - 6.30 PM)	47	27
17 Hours	42	23

The seemingly peculiar variations in these percentages are brought about by the different types of traffic at different periods of the day: work in rush hour, shopping in midday, entertainment in evening.

4. It has reduced the number of transit vehicle movements on the streets, thus making additional street space available for other traffic. Street cars entering and leaving the downtown area per day have dropped from 12,086 to 7,839, a decrease of 4,247 or 35%. Bus movements have dropped from 1,686 to 1,521 or 10%. Street cars have been eliminated entirely on both Yonge St. and Avenue Rd.—two of the main traffic arteries serving the north end.

4. It has increased the security of central city commercial and property values. Soon after it was apparent that the subway was going to be built, there was a noticeable rejuvenation in downtown redevelopment and a new sense of confidence in the future of downtown as a good place to do business. That trend is still continuing, and in addition, other midtown and uptown areas have experienced greatly increased development activity, principally at College, Bloor, St. Clair and Eglinton Ave.—important crosstown feeders to the subway.

6. There has been a very marked increase in property assessments, particularly along the route of the subway and especially in the uptown areas, where the presence of the subway has undoubtedly inspired confidence in speculative developments. From 1950 to 1959 real property assessment in the city increased from \$1,346 million to \$1,788 million, an increase of \$442 million or 33%, but \$240 million or 54% of this was in the 14 ward subdivisions adjacent to the subway, representing only 25% of the city land area. These 14 areas showed an increase in assessment of 45%, while the other 36 areas of the City increased only 25%. Had the 14 increased only 25% it would have made a difference of \$109 million in 1959. At a 56 mill tax rate this could have meant a difference of about \$5 $\frac{1}{2}$  million in 1959 tax revenues. This is nearly 2 $\frac{1}{2}$  times the amount necessary to service the debt on that portion of the Yonge subway costs, represented by the off-street right-of-way and basic structures. It is therefore logical to conclude that it would "pay" the city to underwrite the cost of the latter from the stand-point of civic betterment, commercial and economic stability and increased tax revenue.

#### POPULATION INCREASE AND DISTRIBUTION

Since people are passengers and passengers are the most important ingredient to a successful transit operation, continued study of the trend of population growth and distribution is essential.

The population of Toronto proper has remained static for the past 20 yr—at just under 700,000. From 1930 to 1940 the Metropolitan population of 792,000 increased only 10% and from 1940 to 1945 another 8% to 947,000. From 1945 to 1950 the increase was 108,451 or 11.5% but from 1950 to 1955 it zoomed 249,380

or 23.6%—an average of 50,000 per yr. It appears this will continue for the next few years, at least.

All of the increase in population since World War II has been in the suburban areas, and particularly in the three largest and most outlying townships—North York, Scarboro and Etobicoke with a total area of 182 sq miles of 76% of the entire Metropolitan area. From 1935 to 1945 population increases in these three townships totalled 23,749 and represented only 22.3% of the total Metropolitan increase of 106,367, but from 1945 to 1955 they totalled 277,725 and represented 77.4% of the total increase of 357,831. In the period from 1955 to 1958, these three have increased a further 138,000 representing the entire Metropolitan increase, to the present total of 1,430,000.

It is estimated that the total population in the Toronto Metropolitan area will have increased by approximately 1,000,000 persons between 1955 and 1980, and it is calculated that these will be distributed with respect to the city center as follows: Only 20% within 6 miles; 65% within 6 to 11 miles; and 15% over 11 miles from the city center. In addition, there will be a substantial increase of possibly another 300,000 in areas immediately outside the Metropolitan area, all of them over 10 miles from the city center.

With such large numbers of additional residents to serve at relatively long distances from the city center, plus about 948,000 within a 5-mile radius, it is obvious that extension of off-street rapid transit service is the only method of providing satisfactory public transit service at reasonable rates.

No system of surface transit, operating on public streets and subject to all the adverse factors associated therewith, could hope to provide the capacities and relatively high overall transit speeds, necessary to keep travel times within tolerable limits over such a wide area. Furthermore, no system of surface transit has the amazing capacity of rapid transit facilities to absorb the tremendous surge of rush hour transit loading generated by the thronging multitudes of a great city.

These outlying areas will stand to benefit from rapid transit more than some close-in areas, although, initially at least, no rapid transit lines will actually operate within these outer areas.

#### WHAT OF THE FUTURE?

It is axiomatic in transit planning that lines must be located where people are or want to go in sufficient numbers to justify mass transit service. This is doubly true of rapid transit lines which, while very expensive, can justify their existence where there is sufficient volume and density of traffic to secure a reasonably high usage of their capacity.

When the Yonge subway was first planned it was expected that the first extension would be a crosstown line on Queen St. With that in mind a 100 yard section of a Queen subway for surface cars was constructed under the Yonge subway where they crossed. However, in the intervening decade the trend of development and population increase in the whole area has been such that a crosstown subway on Bloor St. is obviously the next most urgent rapid transit need rather than one on Queen St., because traffic across Bloor St. had increased considerably while that on Queen St. had decreased.

It was recognized, however, that a crosstown line on Bloor St. would attract so much more traffic than the Bloor carline that the transfer movement from it to the Yonge subway would quickly overload the latter south of Bloor St. It

was therefore decided to extend first the Yonge subway up University Ave. parallel to Yonge St. about 2 miles to connect with a Bloor subway about  $\frac{1}{2}$  mile west of Yonge subway. This, in effect, would provide a four-track connection between Bloor and Front Sts., serving the whole downtown area by two lines 3 blocks apart. As a second phase of this scheme it was decided to build a  $7\frac{1}{2}$  mile crosstown line on Bloor St. from Keele to Woodbine Ave. The terminus of the Yonge subway is approximately 4 miles from the city center, and the two ends of the proposed Bloor line would be the same distance.

The travel-time saving to the city center from each of these terminals would be 15 min, and the crosstown-time saving on the Bloor rapid transit line would be 25 min. Those who reap the greatest travel-time savings are those at or beyond the rapid transit terminals. If, in addition, some of the feeder services extending from these terminals are operated "express" in rush hours, as is done from the Eglinton terminal of the Yonge subway, a further saving of 5 to 10 min accrues to those suburbanites located furthest out.

It has been estimated that population in areas tributary to the three initial rapid transit branches will have increased between 1955 and 1980 by a further 800,000 or 89% as follows:

	1955	1980	Increase	%
West	269,000	505,000	236,000	88%
North	385,000	695,000	310,000	81%
East	<u>234,000</u>	<u>480,000</u>	<u>246,000</u>	<u>105%</u>
Total	888,000	1,680,000	792,000	89%

This indicates that the Yonge subway may well be overtaxed within a relatively few years, certainly long before that was anticipated when it was opened for service in 1954. These figures also indicate nearly 500,000 new residents in the areas tributary to the ends of the Bloor line, an ample justification for the projection of rapid transit service to the east and west sections of the city.

Considering the expectation that street cars will have disappeared from the local scene during the late 1970's, and the fact that buses simply could not provide the rapid and economical service demanded by the circumstances indicated by such phenomenal growth, it is obvious that the decision to place principal reliance for mainline operations of the future in off-street rapid transit facilities is a sound one from the stand-point of the city, its citizens, its commercial life and of the Commission, whose responsibility it is to provide the most of the best for the least—in public transportation to the community.

#### GETTING STARTED

Having decided on the urgent need for rapid transit extension across Bloor St. and Danforth Ave., and a parallel service to Yonge Subway south of Bloor St. into the downtown area, the Commission placed this proposal before the Metropolitan Council in the spring of 1955. The Council turned it over for study to the Metropolitan Planning Board which, in May, 1956, reported favorably on it and recommended preparation of functional plans and further studies as to future traffic travel pattern, financing, etc. Following further studies

they reported in October, 1957 in favor of a "U" shaped routing rather than an east-west crosstown route. This matter was finally resolved early in 1958 by public hearings before the Metropolitan Council and the Metropolitan Planning Board in favor of the crosstown routing proposed by the TTC.

The Metropolitan Executive and TTC then met to work out financing. The Commission's position was that, having built the Yonge subway without financial aid from the municipalities, it had obligated itself to the reasonable limit of its financial resources for rapid transit purposes. The Commission held that it was the obligation of the community to provide the rights-of-way on which it operated its services (that is, the public streets); and that when necessity required an off-street exclusive right-of-way for the purpose, it was still the community's responsibility to provide it. The situation was somewhat analogous to that of a limited access expressway for motorists paid for by the taxpayers for the exclusive use of one group of users. The Commission was quite prepared, of course, to accept responsibility for providing railway fixed equipment, rolling stock and the costs of operation out of fare box revenues, as it does on all other transit services operating on city streets.

The Metropolitan Council finally agreed to buy and pay for the right-of-way and to split the remainder of the costs 50-50 with the Commission. The Metropolitan Council proposed to raise most of their commitment by a special 2 mill capital levy each year for 10 yr—applicable to the total assessment in the whole Metropolitan area. This method of financing was attacked as unconstitutional by six or seven of the suburban municipalities when approval was sought from the Ontario Municipal Board. Nevertheless the Ontario Municipal Board approved the project and the proposed method of financing at a series of hearings in August, 1958. The dissenting municipalities, now reduced to three, then appealed to the Appeal Court of Ontario and later to the Supreme Court of Canada, on a point of law as to whether the Municipal Board had exceeded its powers in approving the method of financing proposed by the Metropolitan Council for its share of the cost.

Both appeals were disallowed whereupon the Metropolitan Council and the TTC on April 14 signed the necessary agreements to give this project the "green" light just 4 yr and 40 days after it had first been proposed to the Council.

Contract plans and specifications have been prepared. Contracts were let for the first stage in July, 1959 and actual construction was under way by September—exactly 10 yr since construction started on the Yonge subway.

It would be physically possible to complete the  $9\frac{1}{2}$  miles in about  $5\frac{1}{2}$  yr actual construction time, but, because of a huge Metropolitan program of capital works amounting to about \$1,000,000,000 in the next 10 yr, the Board has ordered that the work be done in three stages stretched out over a 10-yr period, in order to ease the Council's financing problems.

The first stage will be the extension of the present subway University Ave. to Bloor St.—approximately 2 miles. The second stage will be from the St. George Station where the University leg connects with Bloor St. easterly to Greenwood Ave. This is not to be started before 1962. The third stage will complete the  $7\frac{1}{2}$  miles of the Bloor-Danforth line and will not be started until 1967. However, each stage can and will be placed in operation as soon as completed. The final stage is expected to be in operation about the beginning of 1969.

It is anticipated that by that time a further extension of the University line will be required to the north via a new Northwest artery to be constructed by the Metropolitan Council starting about 1964. This will be a limited-access highway in which provision is being made for a center mall wide enough for a rapid transit line. This artery is ideally located to provide a parallel relief route to the Yonge subway, and if development in the area continues at its present rapid rate it will certainly be needed by 1970, if not before.

Discussions are now being held with Metropolitan authorities on the matter of a co-ordinated program of rapid transit and expressway extensions for the future, with a view to combining these facilities on the same rights-of-way where that is possible, economical, and otherwise desirable.

### CONCLUSIONS

The Commission is satisfied that provision of a basic net-work of rapid transit services is an essential ingredient for the economic health and future well-being of any large metropolitan city, because no other transit medium yet devised can supply a service of the capacity and characteristics needed to meet the conditions encountered today, and which will obviously be much worse in the years to come.

THESE THINGS ARE ALL IN THE MIND OF THE MAN WHO SEES THEM.

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Journal of the  
CITY PLANNING DIVISION  
Proceedings of the American Society of Civil Engineers

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PLANNING ACTIVITY IN THE CLEVELAND REGION<sup>a</sup>

By Stephen A. Kaufman<sup>1</sup>

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SYNOPSIS

The Regional Planning Commission has been working steadily on major aspects, preparing Cuyahoga County's general plan. It has undertaken studies of sewerage and water supply, transportation, population land use and regional recreation. Because of close working relationships with county and municipal officials, the Commission and staff are having some effect on current developments.

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INTRODUCTION

The subject should most properly be introduced with a few words about the Regional Planning Commission, Cleveland, Ohio. The territory of the Commission is officially limited to the unincorporated areas of Cuyahoga County and those municipalities which belong to the Commission. These constitute 46 out of the 58 cities and villages in the county and about 15 sq miles in the four pieces of unincorporated township still remaining. For practical purposes, however, it is concerned with planning all of Cuyahoga County and with serving all the people of the county. This is now beginning to mean it is concerned also about land outside the county which its people use and, therefore, their relationships to the residents of the neighboring counties, some of which are metropolitan areas in their own right, with their own county or regional plan-

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Note.—Discussion open until October 1, 1960. To extend the closing date one month, a written request must be filed with the Executive Secretary, ASCE. This paper is part of the copyrighted Journal of the City Planning Division, Proceedings of the American Society of Civil Engineers, Vol. 86, No. CP 1, May, 1960.

<sup>a</sup> Presented at the May 1959 ASCE Convention in Cleveland, Ohio.

<sup>1</sup> Acting Dir., Regional Planning Comm., Cleveland, Cuyahoga Co., Ohio.

ning commissions. Their activities are also significant but there is not sufficient familiarity with them to discuss them here.

This Commission was established in 1947, succeeding a County Planning Commission which had no professional staff and which had no direct representation from suburban municipalities.. These two situations were corrected with the establishment of our Commission and the employment of full-time staff, starting with Mr. Noyes as director in January, 1948.

This is the second metropolitan planning commission established in the county. In 1921, a similar but unofficial commission was established, supported and staffed mostly by the Cleveland City Planning Commission. With a reduction of the latter's funds in 1923, the Metropolitan Planning Commission disappeared.

The staff of the present Commission consists of 20 people, of whom 5 are clerical, the remainder technical. The technical staff work is divided into two major phases: community planning under the supervision of Mr. Abendroth and, the writer's responsibility, regional planning. Most of the staff spend their time in one field or the other but they also shift as the exigencies of the situation may require. The work load varies from time to time in its emphasis but about 4/10 of the man-hours go to regional planning; 3/10 to community planning; and 3/10 to general and administrative responsibilities and to preparation of a Regional building code, which was prepared by Leslie J. Rear-don, F. ASCE, of Case Institute (1959).

#### FUNCTIONS OF THE COMMISSION AND STAFF

Although it does other work, the Regional Planning Commission has only one responsibility under the Ohio law governing its establishment. That is to provide a general plan for the development of the region and this is the major undertaking of the regional work of the staff. The rest of this paper is devoted to the various aspects of this undertaking.

The writer is aware of the traditional academic sequence of reports leading up to the establishment of such a plan. That is: economic base study, population, land use, transportation, recreation and education, public works, urban renewal, zoning, etc. Situations existing at the time of the establishment of the Commission or developing during its early life demanded the adoption of a rather different pattern.

For one thing, a number of other agencies were at work in related activities. Cleveland's Planning Commission adopted a general plan in 1949. The City, County and State engineering and planning agencies, including this one, have been working together on freeway plans since 1940. The transit system has been working on a rapid transit plan since 1943. A series of heavy rains causing bad floods in 1947 dictated the advisability of an early start on a comprehensive sewer plan. The Metropolitan Services Commission was organized in 1956 to undertake studies of governmental organization in the area. In another field, there had been a tradition of private responsibility for economic studies and this required an indirect approach. There was, furthermore, the necessity of establishing as quickly as possible good relations with the municipalities in the area, with the dual purpose of getting them to support the Commission through membership and of making use of the staff for their own planning work. Another factor was the occasional request of the County government for a special study, such as the location of some major facility, which

took up staff time ordinarily devoted to broader aspects of regional studies. For all of these reasons, therefore, the program described proceeded in a somewhat less orderly way than the ideal.

### PAST MAJOR PROJECTS

The first major project in the regional field was a series of sanitation studies related to the establishment of a basis for physical planning of the sewer and water facilities. This was done mainly with a group of advisory committees that prepared a series of reports on metropolitan needs in terms of construction, financial, and legal problems. Fig. 1 is an indication of the complex political relationships for sewage treatment, typical of the handicaps in developing a unified and effective system. These resulted in the passage of a regional water and sewer district law by the State Legislature and the approval of a \$500,000 bond issue by the county's voters to finance the preparation of a regional sewer and water plan.

In addition, the staff got to work quickly on preparation of base maps, both countywide and sectional, and the development of population projections. As the staff grew, it undertook a land-use survey of the entire county, using mainly aerial photographs, supplemented by field checks. This resulted in a major report, "Our Cited County," which summarized the land use and density findings of the survey and pointed out some of the problems, present and future, and guideposts for their solution as the staff saw them.

The next major undertaking was a survey of potential industrial land, culminating in a report, "Land for Industry," similar in format to the land-use study. This was a complete mapping of all land in the county which was thought to have some industrial potential, regardless of zoning. The detailed sectional maps, one showing use and zoning, the other property ownership, acreage and utilities, have been much used by real estate men and engineers interested in site locations within the county.

As a special aspect of land use, the staff investigated the matter of land parceling and discovered that in some municipalities, over 50% of the land required assembly before it could be properly subdivided. This is a problem for which a completely effective solution has not yet been found.

Another major area of interest in which the staff of the Commission has done considerable work has been transportation. Freeway planning has been the responsibility of a group of planners and engineers in the region since the 1940's and the present proposed system is the result of almost 20 yr of active collaboration by the City Engineer and Director of Public Service; the engineers of the City Transit System and Traffic Department; the City and Regional Planning staffs; the County Engineer; and the State Highway Engineer. Its early work was sponsored by the Regional Association, a private nonprofit planning association which had been relatively inactive since the establishment of the Regional Planning Commission.

Various consulting engineers have been employed by the County to review and revise the overall schemes but the actual locations and priority have been the result of decisions made by this group. The plan, first adopted in 1944, is being constantly restudied and revised in the light of our changing needs and new Federal and State policies.

Another aspect of transportation in which this staff has taken particular interest has been rapid transit development. As some of the readers may know,



the Shaker Heights Rapid Transit has been operating ever since the 1920's and after World War II the Cleveland Transit System added the beginnings of a second system of rail rapid transit in the area on the rights-of-way established by the Van Sweringen brothers who built the Shaker Line. It is the Commission's concern to see that rapid transit, freeways, and major parking facilities are properly coordinated and this tentative scheme was submitted several years ago as a basis for discussion. Studies are now in process to implement some of the suggestions.

#### PRESENT PROJECTS OF REGIONAL IMPORTANCE

*Sewer Planning.*—So much for some of the major items of the past. The following covers some of the things which are now being developed.

Earlier reference was made to the regional sewer and water plan, which has just recently been completed after 7 yr of work. After the passage of a \$500,000 bond issue by the people of the County, the County Commissioners agreed that the Regional Planning Commission should have the responsibility for coordinating the development of the plan. The Commission established a coordinating committee of six engineers: three representing various utilities of the City of Cleveland the three representing county-wide interests. E. C. Richardson was appointed as coordinating engineer for the project and three local consulting firms—two for sewers and one for water supply—were employed to undertake major portions of the work. The former worked on designs for certain drainage basins mostly on the east side of the county. The County Sanitary Engineer was assigned work on most of the west side. The first task was the preparation of a county-wide series of base maps, showing all existing sewerage and storm drainage facilities. Then the engineers proceeded to prepare designs, based on target dates of 1970 and 2000. To assist them, the Real Property Inventory of Cleveland was employed to prepare population estimates on a census tract basis.

Having due regard to the necessity for effectuating the plan, the Commission employed a form of financial consultants to study various methods of financing. When the local engineering studies were complete, the firm of Albright & Friel was engaged to review and coordinate them into a unified and effective system. The two reports were completed in 1958.

The writer would like to bring to the attention of the reader, however, two situations which developed in the course of the preparation of the plan in which the Coordinating Committee played an important role in bringing about effective solutions to immediate problems.

In one instance, a serious drainage situation was created by the building of a storm interceptor by the City of Cleveland, which would have created serious flooding conditions downstream. Because of the existence of the Committee and its planning studies, a relatively inexpensive solution which, when complete, will cost in the neighborhood of \$1,400,000 was substituted for the usual pattern of culverting and other heavy construction costing anywhere from \$3,000,000 to \$8,000,000 more and giving much less protection against flooding. The immediate problem was solved by the building of a \$135,000 flood-control dam and retarding basin upstream from the new sewer's outlet. A second basin, downstream from the first and planned at the same time, together with some extra work on the first dam, is now necessary in order to provide protection against a storm of 50-yr frequency.

The second situation concerned an overloaded sewage treatment plant in what is called the "hilltop area" on the east side of the county. The cost of enlarging this to adequate size was so great that the tributary area's financial potential would have limited it to a size which would have been overloaded the day it was completed.

Study by the committee, however, disclosed nearby problems of an overload at the City of Euclid plant and an excess of capacity in another plant, the Easterly Cleveland plant. The solution was to divert, through pumping, the sewage flow to the original small plant and a large part of that to the Euclid Plant into the easterly Cleveland plant at a cost of about \$1,500,000. This solution achieved not only a savings of \$2,000,000 because of the cost of additional construction which would have been required but brought about \$50,000 a year increased sewer revenue at little or no additional cost to the Cleveland system and brought that operation to a higher level of efficiency. In other words, the investment of \$500,000 in sewer planning has already saved the people of this county an estimated \$5,000,000 to \$10,000,000.

If the plan is effectuated there will be other such achievements in the future and we can look forward to a more rational and economical development of the system on a unified rather than a piecemeal basis.

*Population Studies.*—Reference was made to population studies done both by the Commission's staff and consultants. In the past several years this information has been developed into a more coordinated and comprehensive series of projections. A preliminary report on these current studies was issued jointly with the Metropolitan Service Commission in 1956. This submitted a range of estimates for 1970 and 1975 for both population and occupied dwellings. It also indicated some of the future population characteristics, particularly age groups. This was expanded into greater detail in a second report on population by Thaddeus Tercyak of the staff, issued in 1957. It covered such things as the distribution of population by municipalities, age, sex, employment, and racial characteristics. For staff estimates by census tract, credit must be given to the excellent cooperation of the Cleveland City Planning staff, as well as to the previous work of earlier staff assistants and consultants.

The completion of this stage, was an opportune time to check the estimates against future employment potentials, and the staff gave considerable study to employment projections based on both national and local material. This resulted in a series of projections for our major industries as well as for employment in manufacturing as a whole. These were submitted to a group of about twenty five outstanding men in the community, both economic analysts and industrial leaders. An interview was held with each of these gentlemen, after which the staff prepared a third report on population, which gave the results of these comparisons.

The staff is now entering the last stage of the population study, which is the development of estimates of housing demands within Cuyahoga County. These will be much aided by analysis of census housing data by age of the head of the household to which other characteristics will be related. In this work the staff is doing some exploration of undeveloped methods and is hopeful that it will be making a useful contribution to the techniques of city planning.

*Other Major Studies.*—Another area in which some pioneering study has been done is that of the business district study. This also has been a longtime project, supervised by Melvin Roebuck, taking much more man-power than was first thought necessary. The staff surveyed some 99 business districts, including both historic ones and designed shopping centers, in the outer fringes

of Cleveland and in its suburbs. Each one was mapped as to the existing pattern of business uses, breaking the categories down into various types of commercial activity, the principal groupings being convenience goods and services, shopping goods, auto services and nonrelated uses. "One shot" counts were made of parking facilities and occupancy in these areas to produce a second series of maps and a third series shows the existing zoning.

Having inventoried these physical characteristics, the staff then proceeded to find out what people were served by each of these centers by interviewing shoppers, mainly in the supermarkets, variety, and department stores of each center. Excellent cooperation was secured from nearly all of the store owners. Only in a few situations did the staff have to interview on the street or record license plates. About 35,000 interviews were made, covering almost one-tenth of the families in Cuyahoga County. These people were asked how they had come to the shopping center; where their home was; and what stores they had or were going to visit other than the one they were in. This data was mapped and tabulated and subjected to very comprehensive analyses.

One of the results is shown in Fig. 2, which indicates the ratio of supporting families to the store area devoted to convenience and shopping goods. This shows a strong pattern which centralizes about a line which maintains a ratio of almost exactly 25 sq ft per hundred supporting families. The staff is now in the process of projecting this information to the year 1970 and hopes to complete a report giving the findings and conclusions on this study.

Another major element of the metropolitan program is a study of recreation and open space facilities, not only in this county but in the six surrounding counties, since there, and in fact even beyond, are the places where Cuyahoga County people now find their recreation.

The study has two aspects. One is a determination of the open space pattern within Cuyahoga County and this covers not only recreational uses but institutional and utility installations which also involve open land, such as orphanages and television stations. The development of this inventory will be important as the staff gets into the general question of county recreation, open space and land use plans. It is anxious that a permanent system of free spaces effectively cover the entire county.

The other aspects of the study is an inventory and plan for the development of major regional recreational facilities. These include not only the metropolitan parks but also such things as golf courses, children's camps, especially those sponsored by group work institutions, and commercial picnic grounds. The physical survey of such facilities within the county has been completed and the staff is proceeding rapidly to complete the survey outside the county. The staff will make a number of studies relating to the use of the facilities, finding out the number of people present on holidays, on normal Sundays, and during the week. Very little such surveying has been done in the past and it is necessary to pioneer in the development of techniques for this kind of work. One aspect of this survey will probably be a series of home interviews of a sample of the county's population to find out about the overall pattern of outdoor activity and especially about why people do not use the parks.

Financing a large portion of this study is the Cleveland Metropolitan Park District, which has employed the staff of the Commission to develop a plan for the expansion of its facilities. Consequently, the major emphasis will be on the metropolitan type of park reservation. The group work agencies, such as the Y. M. C. A., the settlement houses, and the Girl Scouts, are also greatly in need of both day camp and overnight facilities and these will be an important part of the plan.

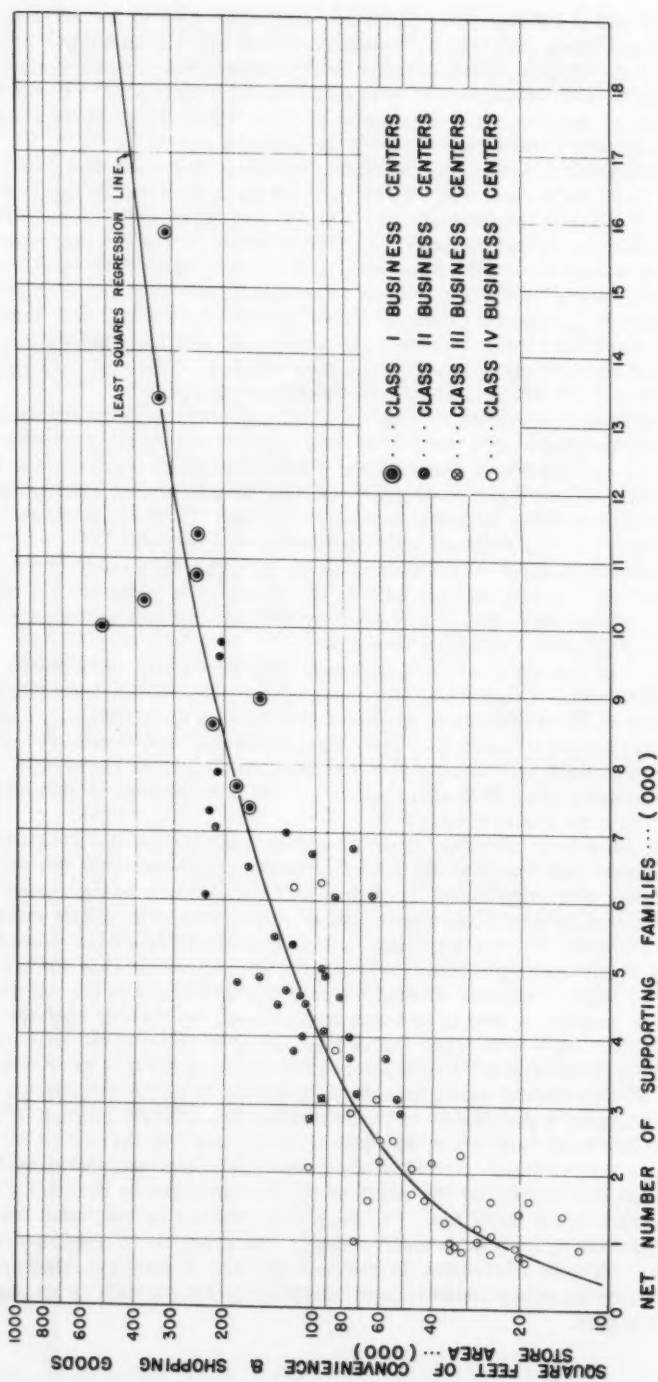


FIG. 2.—RELATION BETWEEN SUPPORTING FAMILIES AND STORE AREA

Related to this study, but covering a broader range of uses and public services is a study of the lake front in Cuyahoga County. Six different municipalities front on the lake. Most of the land is used for residential purposes but there is a continuing demand that more of it be available for metropolitan recreation facilities and much needs to be done to explore the possibilities. Closely related are the problems of providing adequate communication and transportation facilities, of bringing the water to a proper standard of cleanliness and of protecting the land areas from the damage of wind and wave. Much land has been lost in the past few years because of inadequate protective devices and an important part of the study must relate to this problem.

The Regional Planning Commission has no direct responsibility for the planning of pollution abatement nor for the development of port facilities. Naturally, however, the Commission is very much interested in them and preliminary reports have been developed discussing their present status and future prospects. The staff has completed a general land-use map and is now working on a water front recreation inventory and getting data on the demand for such things as marinas and other boating facilities.

### CONCLUSIONS

The foregoing constitutes the main areas of study which this agency is undertaking at the present time, each one a step towards the development of an overall comprehensive plan for the region. The next step is to bring all of these proposals together and attempt to work the land-use demands into a balanced pattern so that there will be a place for everything the people need and everything will be assigned to its place. The writer looks forward to the preparation of a tentative comprehensive plan. Meanwhile, the Commission and its staff are attempting to coordinate improvements as they come along and to find their appropriate locations in terms of what they now know about the community and its future and in terms of what is practicable. As an example of this, the staff is reviewing a proposed location for a part of the freeway system, the Outer Belt South, where considerable dislocation of housing and community facilities is involved. Thus, it is attempting to be useful in applying planning principles to more immediate problems, as well as to the long range solution.

Although most of the work is done in the office by the staff (and this is the method most preferred), there are other ways that are used when staff resources are inadequate. The reader will recall references to both advisory committees and professional consultants. These, especially the former, not only give the staff the benefit of superior knowledge but also are effective in establishing better public relations. Where it is appropriate the Regional Planning Commission joins other agencies in sharing responsibility rather than assuming it all, as in the highway planning. It will attempt the same relationship in the development of the recreation planning, hoping that a jointly developed scheme will be more fruitful in its results.

One more, and a very important, aid in relating future plans to the present development is the work done in assisting the planning of the local municipalities, which the Commission serves as consultant. This acts both as a kind of check on the validity of staff ideas, and as a means of effectuation of overall planning studies. Naturally there are compromises. The writer merely wants to point out that the combination of the two kinds of work in a single office,

with many members of the staff participating in both activities, has developed a much more meaningful approach to and philosophy about planning and planning administration than would have existed otherwise.

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## DISCUSSION

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Note.—This paper is a part of the copyrighted Journal of the City Planning Division, Proceedings of the American Society of Civil Engineers, Vol. 86, No. CP 1, May, 1960.

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FREEWAYS IN URBAN PLANNING<sup>a</sup>

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Closure by Harold M. Lewis

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HAROLD M. LEWIS,<sup>1</sup> F. ASCE.—The written discussions of the paper on "Freeways in Urban Planning" have brought out the differences in terminology when one talks or writes about various types of expressways, and the variations in procedures in different states in designing the federal-aid interstate highway system. They have also elaborated on the problems that occur in urban areas when freeways cross through them.

Messrs. Haber and Miller quoted the definition of a "freeway" advanced by the American Association of State Highway Officials (AASHO) and suggested that the writer should tie in Edward M. Bassett's 1930 definition with this later "presently accepted definition." Since Mr. Bassett made his proposal, a variety of terms have been applied to modern express routes designed to serve both passenger and commercial vehicles, including: "freeways," "expressways," "controlled-access highways," "limited-access highways," "superhighways," and (in the 1956 Highway Act) "national system of interstate and defense highways." Highway engineers and city planners need a standard terminology.

The writer believes that the term "expressways" should cover all types of highways where the design aims at uninterrupted movement and the elimination of the right of direct access from abutting property, whether or not such routes are limited to certain types of vehicles and whether the control of access is "full" or "partial" as those terms are used in the AASHO definition.

A "freeway" should serve both passenger and commercial vehicles, have full control over access, and be free of crossings at grade and lefthand turns. A "parkway" should be an expressway limited to passenger vehicles, with control of access through the fact that its roadway lies within a strip of parkland, said strip being a part of the "parkway." The writer does not believe that Mr. Bassett pictured a parkway as being completely free of grade crossings, as the modern parkway is with some occasional exception in rural areas where traffic did not justify the cost of a grade separation. As traffic increases such grade crossings should be eliminated. There appears to be no basic conflict with the definitions suggested above and those of either Mr. Bassett or the AASHO.

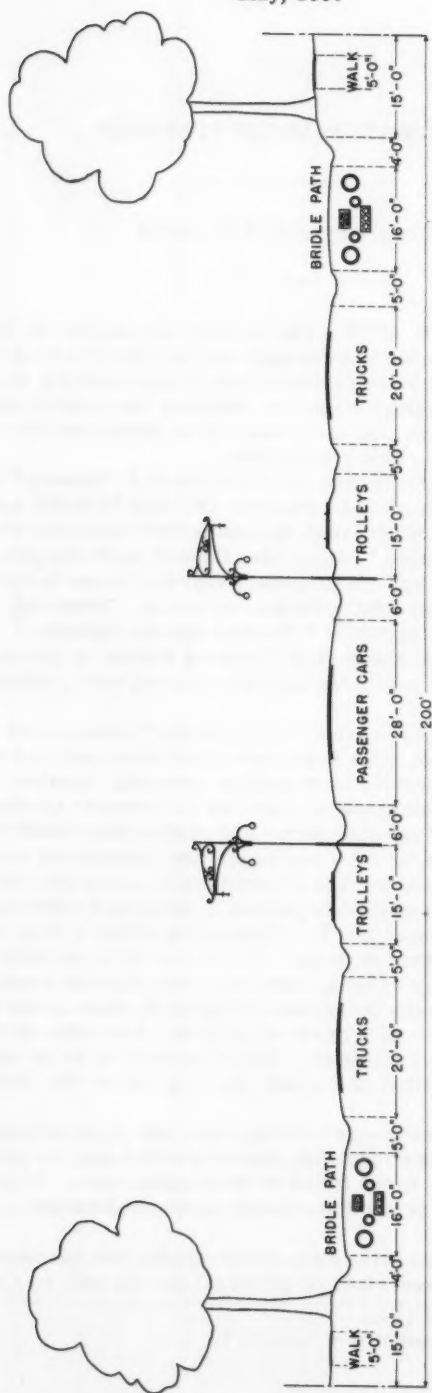
While there is now a continuous freeway from New York to Chicago via the Pennsylvania and other state turnpikes, there is still a gap, as pointed out by Messrs. Haber and Miller, in the Maine to Washington route. This gap will be filled in by freeways now planned and partly under construction in both Delaware and Maryland.

The procedure described in the paper for developing the interstate freeways was not presented as a prescribed or universal one but only as a typical one,

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<sup>a</sup> June, 1959, by Harold M. Lewis.

<sup>1</sup> Cons. Engr. and City Planner, New York, N. Y.



The right-of-way of the du Pont road is 200 feet wide. At present the central 40 feet is being constructed as a first-class road. As the country develops, trolley tracks, roadways for heavy freight traffic and footwalks will be added. The above drawing suggests the possible ultimate lay-out of the whole highway.

FIG. 1.—THE TWO-HUNDRED-FOOT HIGHWAY THROUGH THE STATE OF DELAWARE

having in mind particularly that which has been followed in Delaware. It is recognized that some of the larger states handle more of the detail with their State Highway Department staffs. The Delaware State Highway Department suggested in the fall of 1959 that, because of cutbacks on federal spending for the interstate system, the state complete as a toll road, to be financed by revenue bonds, the one route now under construction so that future available federal funds could be allotted to the other two Delaware routes.

The writer fully agrees with Messrs. Haber and Miller on the need for closer cooperation between state highway departments and local planning and zoning agencies as well as local civic and business groups.

The superhighway proposal advanced by the late T. Coleman duPont is of historical interest and a cross-section based on a sketch supplied by Mr. Haber is shown in Fig. 1. The proposal contained no provision for grade separations at intersections nor for access to abutting property, although the inclusion of trolley tracks implies that considerable development was expected to follow the superhighway construction. The total right-of-way width is comparable to the 204 ft in Mr. Turner's proposal of 1924, mentioned in the paper, but the latter was much more realistic in the allocation of space and width of roadways. The duPont Parkway and duPont Boulevard which grew out of Mr. duPont's proposal is now a dual highway with a wide central mall.

The writer described in his paper those features of a city plan which have been most seriously affected by freeways that cross through their areas. In discussing these, Mr. Herrold pointed out the different points of view from which highway departments and city planners approach their problems. He would like to keep freeways out of cities where possible and suggests that the first step in a location study should be "that each city decide whether it wants a freeway or not." This would seem an attempt to solve a regional and interstate problem from a local point of view, which as pointed out in the paper, may simply move the freeway location to a bordering community where opposition may be equally vocal.

Even though a municipality may not want a freeway to pass through it, it does want convenient access to the interstate system. The provision of such access may involve serious dislocations of population and business through street widenings and other needed improvements.

There are examples of close cooperation between public works officials of local and state governments, such as was carried out in Contra Costa County in California.<sup>2</sup> What Mr. Herrold stressed is the necessity of bringing the city planners into the picture in the preliminary stages of discussion. Similarly, Messrs. Haber and Miller urged that local planning commissions should "make it their business to inquire into the state or regional agency plans." Some state highway departments have recently appointed city planners to their staff. This is helpful, but still leaves it desirable to obtain the combined benefits of local, metropolitan, and state planning in determining the best location of the interstate freeways and the location and design of their connections with urban areas. It is within these urban areas that most of the freeway traffic originates and is destined.

Mr. Herrold refers to a case in a capital city where he feels a downtown location has violated sound planning principles. There are other cases, however, where planning commissions have urged downtown locations and they have worked out advantageously. Two such cases have occurred along that part of

<sup>2</sup> "A Plan for a County Motor Vehicle Transportation System," by Victor W. Sauer, Proceedings, ASCE, Vol. 85, No. HY 3, September, 1959.

the Connecticut Turnpike which has since been incorporated in the interstate system of federal freeways.

The Bridgeport section of the Connecticut Turnpike was originally planned as a freeway relocation of part of U. S. Route No. 1. Original plans of the Connecticut State Highway Department favored a location passing some distance north of the central business district. After much discussion of alternative routes, the State Highway Commissioner announced on May 28, 1952, a southerly location as recommended by the Bridgeport City Planning Commission. This passed through the edge of the central business district, eliminated a substantial area of blight in accordance with plans of the Redevelopment Agency, and provided convenient connections for downtown shoppers and the city's main industrial areas. The need for costly feeder routes was eliminated.

The other example is in New Haven, where the turnpike location has resulted from outstanding cooperation between the state and federal highway agencies, the city's planning commission, redevelopment agency and traffic department, private commercial interests, and institutions. The resulting location skirted the central business area, passing through industrial areas and crossing part of the harbor so as to create new land by reclamation, and including an Oak Street Connector to the core of the city and tied in with a Church Street redevelopment project. Along this connector the city's oldest slum area was cleared and the combined redevelopment plans include modern apartments, retail shops, offstreet parking, a hotel, and a new telephone company building.

It is evident, therefore, that the answer as to where freeways should go varies with the city and its region and their peculiar conditions, but, if there are both city and regional master plans that have been coordinated and if the planning commissions' viewpoints are given full consideration, the location decided upon should be a sound one.

SAN DIEGO TRANSPORTATION PLANNING STUDIES<sup>a</sup>

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Corrections

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CORRECTIONS.—In the December 1959 Journal of the City Planning Division, Fig. 8 on page 24 did not reproduce properly. For the convenience of the reader, the correct Fig. 8 is reproduced herewith.

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<sup>a</sup> December, 1959, by Edward M. Hall.

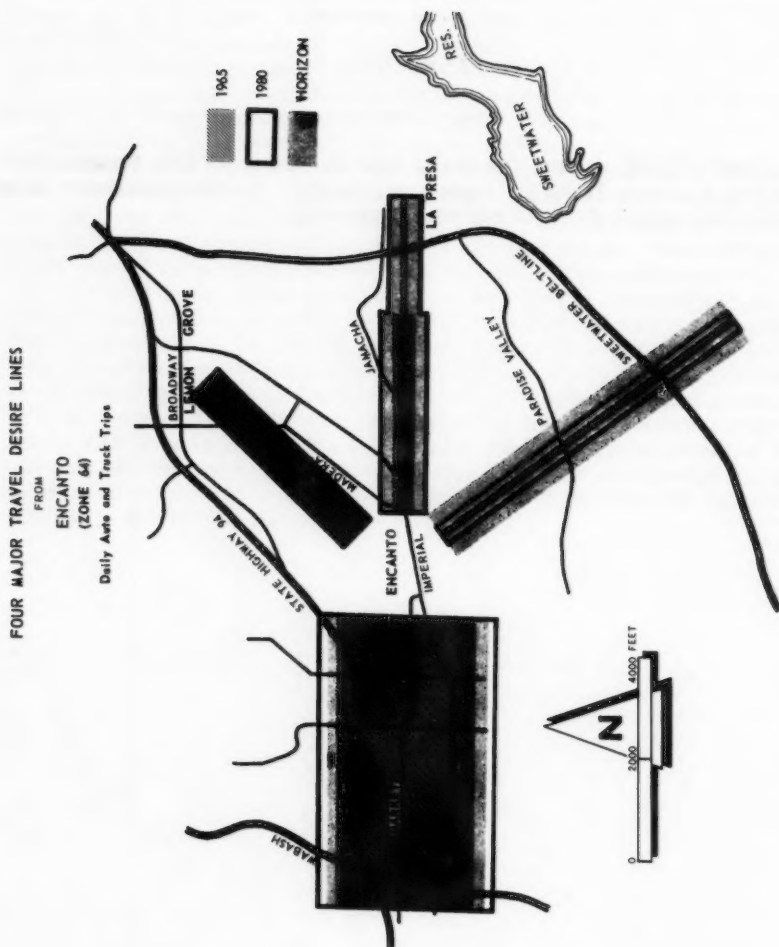


FIG. 8.—SAN DIEGO METROPOLITAN AREA TRANSPORTATION STUDY

COORDINATING PUBLIC WORKS AND URBAN RENEWAL  
IN KANSAS CITY, KANSAS<sup>a</sup>

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Discussion by Charles E. Doell

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CHARLES E. DOELL,<sup>1</sup> F. ASCE.—A relatively minor, but nevertheless important point in the excellent article on the above subject by Messrs. Lovelace and Doran involves the boundary lines of the park areas indicated on the schematic neighborhood plan. The authors are to be commended for increasing the amount of acreage devoted to parks. However, arranging the boundaries so that they come at the back of lots facing streets rather than having streets or other ways bordering and outlining the park usually produces a rather impractical condition.

It is recognized that park areas bounded by streets often appear to planners to be expensive in that the streets, curbs, walks, and utilities under the street are used for the residences of only one side of the street. However, if the interests of the entire public that are expected to use the property are to be considered, adequate access on all sides must be ever available. On the plan shown by the authors, access to the interior park areas is obtained through relatively narrow passageways. To the casual observer this would seem to be adequate, but there are points to consider. A line dividing private property from public property is a tenuous division. If the park area is to be used intensively at all, the private property owner tends to consider the adjacent park land much as he would his own, and not infrequently, encroaches upon it for certain of his own uses. He is apt to resent too many park users congregating opposite his own house and close to his own yard. He certainly resents any encroachment, by the public, of his own property that might frequently occur. Irritation arises on the part of both private property holders and the public. Fences, hedges, and other plantings to divide the properties are only weak substitutes for the real thing. Long experience in administrative matters of this sort leads to the conclusion that very seldom does anything short of a "public way" prove satisfactory as a separation of public park and private property.

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<sup>a</sup> December, 1959, by Eldridge H. Lovelace and Ramon Duran.

<sup>1</sup> Supt. of Parks, Emeritus, Minneapolis, Minn.



# PROCEEDINGS PAPERS

The technical papers published in the past year are identified by number below. Technical-division sponsorship is indicated by an abbreviation at the end of each Paper Number, the symbols referring to: Air Transport (AT), City Planning (CP), Construction (CO), Engineering Mechanics (EM), Highway (HW), Hydraulics (HY), Irrigation and Drainage (IR), Pipeline (PL), Power (PO), Sanitary Engineering (SA), Soil Mechanics and Foundations (SM), Structural (ST), Surveying and Mapping (SU), and Waterways and Harbors (WW), divisions. Papers sponsored by the Department of Conditions of Practice are identified by the symbols (PP). For titles and order coupons, refer to the appropriate issue of "Civil Engineering." Beginning with Volume 82 (January 1956) papers were published in Journals of the various Technical Divisions. To locate papers in the Journals, the symbols after the paper number are followed by a numeral designating the issue of a particular Journal in which the paper appeared. For example, Paper 2270 is identified as 2270(ST9) which indicates that the paper is contained in the ninth issue of the Journal of the Structural Division during 1959.

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- MAY: 2014(AT2), 2015(AT2), 2016(AT2), 2017(HY5), 2018(HY5), 2019(HY5), 2020(HY5), 2021(HY5), 2022(HY5), 2023(PL2), 2024(PL2), 2025(PL2), 2026(PP1), 2027(PP1), 2028(PP1), 2029(PP1), 2030(SA3), 2031(SA3), 2032(SA3), 2033(SA3), 2034(ST5), 2035(ST5), 2036(ST5), 2037(ST5), 2038(PL2), 2039(PL2), 2040(AT2)<sup>c</sup>, 2041(PL2)<sup>c</sup>, 2042(PP1)<sup>c</sup>, 2043(ST5)<sup>c</sup>, 2044(SA3)<sup>c</sup>, 2045(HY5)<sup>c</sup>, 2046(PP1), 2047(PP1).
- JUNE: 2048(CP1), 2049(CP1), 2050(CP1), 2051(CP1), 2052(CP1), 2053(CP1), 2054(CP1), 2055(CP1), 2056(HY6), 2057(HY6), 2058(HY6), 2059(IR2), 2060(IR2), 2061(PO3), 2062(SM3), 2063(SM3), 2064(SM3), 2065(ST8), 2066(WW2), 2067(WW2), 2068(WW2), 2069(WW2), 2070(WW2), 2071(WW2), 2072(CP1)<sup>c</sup>, 2073(IR2)<sup>c</sup>, 2074(PO3)<sup>c</sup>, 2075(ST6)<sup>c</sup>, 2076(HY6)<sup>c</sup>, 2077(SM3)<sup>c</sup>, 2078(WW2)<sup>c</sup>.
- JULY: 2079(HY7), 2080(HY7), 2081(HY7), 2082(HY7), 2083(HY7), 2084(HY7), 2085(HY7), 2086(SA4), 2087(SA4), 2088(SA4), 2089(SA4), 2090(SA4), 2091(EM3), 2092(EM3), 2093(EM3), 2094(EM3), 2095(EM3), 2096(EM3), 2097(HY7)<sup>c</sup>, 2098(SA4)<sup>c</sup>, 2099(EM3)<sup>c</sup>, 2100(AT3), 2101(AT3), 2102(AT3), 2103(AT3), 2104(AT3), 2105(AT3), 2106(AT3), 2107(AT3), 2108(AT3), 2109(AT3), 2110(AT3), 2111(AT3), 2112(AT3), 2113(AT3), 2114(AT3), 2115(AT3), 2116(AT3), 2117(AT3), 2118(AT3), 2119(AT3), 2120(AT3), 2121(AT3), 2122(AT3), 2123(AT3), 2124(AT3), 2125(AT3).
- AUGUST: 2126(HY8), 2127(HY8), 2128(HY8), 2129(HY8), 2130(PO4), 2131(PO4), 2132(PO4), 2133(PO4), 2134(SM4), 2135(SM4), 2136(SM4), 2137(SM4), 2138(HY8)<sup>c</sup>, 2139(PO4)<sup>c</sup>, 2140(SM4)<sup>c</sup>.
- SEPTEMBER: 2141(CO2), 2142(CO2), 2143(CO2), 2144(HW3), 2145(HW3), 2146(HW3), 2147(HY9), 2148(HY9), 2149(HY9), 2150(HY9), 2151(IR3), 2152(ST7)<sup>c</sup>, 2153(IR3), 2154(IR3), 2155(IR3), 2156(IR3), 2157(IR3), 2158(IR3), 2159(IR3), 2160(IR3), 2161(SA5), 2162(SA5), 2163(ST7), 2164(ST7), 2165(SU1), 2166(SU1), 2167(WW3), 2168(WW3), 2169(WW3), 2170(WW3), 2171(WW3), 2172(WW3), 2173(WW3), 2174(WW3), 2175(WW3), 2176(WW3), 2177(WW3), 2178(CO3)<sup>c</sup>, 2179(IR3)<sup>c</sup>, 2180(HW3)<sup>c</sup>, 2181(SA5)<sup>c</sup>, 2182(HY9)<sup>c</sup>, 2183(SA5)<sup>c</sup>, 2184(WW3)<sup>c</sup>, 2185(PP2)<sup>c</sup>, 2186(ST7)<sup>c</sup>, 2187(PP2), 2188(PP2).
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- NOVEMBER: 2241(HY11), 2242(HY11), 2243(HY11), 2244(HY11), 2245(HY11), 2246(SA6), 2247(SA6), 2248(SA6), 2249(SA6), 2250(SA6), 2251(SA6), 2252(SA6), 2253(SA6), 2254(SA6), 2255(SA6), 2256(ST9), 2257(ST9), 2258(ST9), 2259(ST9), 2260(HY11), 2261(ST9)<sup>c</sup>, 2262(ST9), 2263(HY11), 2264(ST9), 2265(HY11), 2266(SA6), 2267(SA6), 2268(SA6), 2269(HY11)<sup>c</sup>, 2270(ST9).
- DECEMBER: 2271(HY12)<sup>c</sup>, 2272(CP2), 2273(HW4), 2274(HW4), 2275(HW4), 2276(HW4), 2277(HW4), 2278(HW4), 2279(HW4), 2280(HW4), 2281(IR4), 2282(IR4), 2283(IR4), 2284(SA1), 2285(PO6), 2286(PO6), 2287(PO6), 2288(PO6), 2289(PO6), 2290(PO6), 2291(PO6), 2292(SM6), 2293(SM6), 2294(SM6), 2295(SM6), 2296(SM6), 2297(WW4), 2298(WW4), 2299(WW4), 2300(WW4), 2301(WW4), 2302(WW4), 2303(WW4), 2304(HW4), 2305(ST10), 2306(CP2), 2307(CP2), 2308(ST10), 2309(CP2), 2310(HY12), 2311(HY12), 2312(PO6), 2313(PO6), 2314(ST10), 2315(HY12), 2316(HY12), 2317(HY12), 2318(WW4), 2319(SM6), 2320(SM6), 2321(ST10), 2322(ST10), 2323(HW4)<sup>c</sup>, 2324(CP2)<sup>c</sup>, 2325(SM6)<sup>c</sup>, 2326(WW4)<sup>c</sup>, 2327(IR4)<sup>c</sup>, 2328(PO6)<sup>c</sup>, 2329(ST10)<sup>c</sup>, 2330(CP2).

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- JANUARY: 2331(EM1), 2332(EM1), 2333(EM1), 2334(EM1), 2335(HY1), 2336(HY1), 2337(EM1), 2338(EM1), 2339(HY1), 2340(HY1), 2341(SA1), 2342(EM1), 2343(SA1), 2344(ST1), 2345(ST1), 2346(ST1), 2347(ST1), 2348(EM1)<sup>c</sup>, 2349(HY1)<sup>c</sup>, 2350(ST1), 2351(ST1), 2352(SA1)<sup>c</sup>, 2353(ST1)<sup>c</sup>, 2354(ST1).
- FEBRUARY: 2355(CO1), 2356(CO1), 2357(CO1), 2358(CO1), 2359(CO1), 2360(CO1), 2361(PO1), 2362(HY2), 2363(ST2), 2364(HY2), 2365(SU1), 2366(HY2), 2367(SU1), 2368(SM1), 2369(HY2), 2370(SU1), 2371(HY2), 2372(PO1), 2373(SM1), 2374(HY2), 2375(PO1), 2376(HY2), 2377(CO1)<sup>c</sup>, 2378(SU1), 2379(SU1), 2380(SU1), 2381(HY2)<sup>c</sup>, 2382(ST2), 2383(SU1), 2384(ST2), 2385(SU1)<sup>c</sup>, 2386(SU1), 2387(SU1), 2388(SU1), 2389(SM1), 2390(ST2)<sup>c</sup>, 2391(SM1)<sup>c</sup>, 2392(PO1)<sup>c</sup>.
- MARCH: 2393(IR1), 2394(IR1), 2395(IR1), 2396(IR1), 2397(IR1), 2398(IR1), 2399(IR1), 2400(IR1), 2401(IR1), 2402(IR1), 2403(IR1), 2404(IR1), 2405(IR1), 2406(IR1), 2407(SA2), 2408(SA2), 2409(HY3), 2410(ST3), 2411(SA2), 2412(HW1), 2413(WW1), 2414(WW1), 2415(HY3), 2416(HW1), 2417(HW3), 2418(HW1)<sup>c</sup>, 2419(WW1)<sup>c</sup>, 2420(WW1), 2421(WW1), 2422(WW1), 2423(WW1), 2424(SA2), 2425(SA2)<sup>c</sup>, 2426(HY3)<sup>c</sup>, 2427(ST3)<sup>c</sup>.
- APRIL: 2428(ST4), 2429(HY4), 2430(PO2), 2431(SM2), 2432(PO2), 2433(ST4), 2434(EM2), 2435(PO2), 2436(ST4), 2437(ST4), 2438(HY4), 2439(EM2), 2440(EM2), 2441(ST4), 2442(SM2), 2443(HY4), 2444(ST4), 2445(EM2), 2446(ST4), 2447(EM2), 2448(SM2), 2449(HY4), 2450(ST4), 2451(HY4), 2452(HY4), 2453(EM2), 2454(EM2), 2455(EM2)<sup>c</sup>, 2456(HY4)<sup>c</sup>, 2457(PO2)<sup>c</sup>, 2458(ST4)<sup>c</sup>, 2459(SM2)<sup>c</sup>.
- MAY: 2460(AT1), 2461(ST5), 2462(AT1), 2463(AT1), 2464(CP1), 2465(CP1), 2466(AT1), 2467(AT1), 2468(SA3), 2469(HY3), 2470(ST5), 2471(SA3), 2472(SA3), 2473(ST5), 2474(SA3), 2475(ST5), 2476(SA3), 2477(ST5), 2478(HY3), 2479(SA3), 2480(ST5), 2481(SA3), 2482(CO2), 2483(CO2), 2484(HY3), 2485(HY3), 2486(AT1)<sup>c</sup>, 2487(CP1)<sup>c</sup>, 2488(CO2)<sup>c</sup>, 2489(HY3)<sup>c</sup>, 2490(SA3)<sup>c</sup>, 2491(ST5)<sup>c</sup>, 2492(CP1), 2493(CO2).

c. Discussion of several papers, grouped by divisions.

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